DOCUMENT RESUME

ED 430 783 SE 062 524

AUTHOR	Coxford, Arthur F.; Fey, James T.; Hirsch, Christian R.; Schoen, Harold L.; Burrill, Gail; Hart, Eric W.; Watkins, Ann E.
TITLE	Contemporary Mathematics in Context: A Unified Approach. Core-Plus Mathematics Project: Scope & Sequence.
INSTITUTION	Everyday Learning Corp., Chicago, IL.
SPONS AGENCY	National Science Foundation, Arlington, VA.
ISBN	ISBN-1-57039-499-7
PUB DATE	1998-00-00
NOTE	15p.; "With Mary Jo Messenger and Beth Ritsema."
AVAILABLE FROM	Everyday Learning Corporation, P.O. Box 812960, Chicago, IL 60681.
PUB TYPE	Reports - Descriptive (141)
EDRS PRICE	EDRS Price MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	*Academic Standards; High Schools; *Mathematics Curriculum; *Mathematics Instruction; Program Descriptions
IDENTIFIERS	*Core Plus Mathematics Project; NCTM Curriculum and Evaluation Standards; NCTM Professional Teaching Standards

ABSTRACT

Contemporary Mathematics in Context is a four-year, integrated mathematics program developed by the Core-Plus Mathematics Project (CPMP) at the Everyday Learning Corporation. The program features student and teacher materials for a three-year core curriculum for all students as well as a fourth-year course continuing the preparation of students for college mathematics. The materials were designed to implement the vision of high school mathematics as portrayed in the National Council of Teachers of Mathematics (NCTM) Curriculum and Evaluation Standards for School Mathematics and Professional Standards for Teaching Mathematics. Each course of Contemporary Mathematics in Context (CMIC) features "strands" of algebra and functions, statistics and probability, geometry and trigonometry, and discrete mathematics. These strands are connected within units by fundamental ideas such as symmetry, functions, matrices, data analysis, and curve-fitting. The strands are also connected across units by mathematical habits of mind such as visual thinking, recursive thinking, searching for and describing patterns, making and checking conjectures, reasoning with multiple representations, inventing mathematics, and providing convincing arguments. The strands are linked further by the fundamental themes of data, representation, shape, and change. Important mathematical ideas are continually revisited through these connections so that students can develop a healthy understanding of mathematics. Each of the first three courses of the CMIC curriculum consists of seven units and a culminating capstone experience. The final element of each course--the capstone--is a thematic, two-week, project-oriented activity that enables students to pull together and apply the important mathematical concepts and methods developed over the entire course. Unit titles for the three-year core curriculum for all students are presented in a table. Each of the four strands is divided into major categories, under which are found the mathematical topics addressed in CMIC. (ASK)

CORE-PLUS MATHEMATICS PROJECT

Scope & Sequence

algebra and functions

statistics and probability

geometry and trigonometry

discrete mathematics

ED 430 783

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2B

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

Minor changes have been made to improve reproduction quality.

Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Contemporary Mathematics in Context

A Unified Approach

BEST COPY AVAILABLE

EVERYDAY LEARNING CORPORATION

CORE-PLUS MATHEMATICS PROJECT

Scope and Sequence

Contemporary Mathematics in Context

A Unified Approach

Arthur F. Coxford
James T. Fey
Christian R. Hirsch
Harold L. Schoen
Gail Burrill
Eric W. Hart
Ann E. Watkins
with
Mary Jo Messenger
Beth Ritsema

EVERYDAY LEARNING

Chicago, Illinois

This project was supported, in part, by the National Science Foundation. Opinions expressed are those of the authors and not necessarily those of the Foundation.

Everyday Learning Development Staff

Editorial: Anna Belluomini, Eric Karnowski, Steve Mico, Carol Zacny

Production/Design: Jess Schaal, Norma Underwood

Additional Credit: Darrel A. Trulson

ISBN 1-57039-499-7

Copyright © 1999 Everyday Learning Corporation. All rights reserved. Printed in the United States of America. This publication is protected by copyright, and permission should be obtained from the publisher prior to any form of reproduction or unauthorized use. Any questions regarding this policy should be addressed to:

Everyday Learning Corporation
P.O. Box 812960
Chicago, IL 60681

1 2 3 4 5 6 7 8 9 XX 03 02 01 00 99

About the *Core-Plus Mathematics Project*

The **Core-Plus Mathematics Project (CPMP)** was funded by the National Science Foundation to develop student and teacher materials for a comprehensive high school mathematics curriculum. Courses 1–3 comprise a core curriculum appropriate for *all* students. Course 4 continues the preparation of students for college mathematics.

Project Director
Christian R. Hirsch
Western Michigan University

Project Co-Directors
Arthur F. Coxford
University of Michigan

James T. Fey
University of Maryland

Harold L. Schoen
University of Iowa

Senior Curriculum Developers
Gail Burrill
University of Wisconsin-Madison

Eric W. Hart
Western Michigan University

Brian A. Keller
Iowa State University

Ann E. Watkins
California State University, Northridge

Professional Development Coordinator
Beth Ritsema
Western Michigan University

Evaluation Coordinator
Steven W. Ziebarth
Western Michigan University

Advisory Board
Diane Briars
Pittsburgh Public Schools

Jeremy Kilpatrick
University of Georgia

Kenneth Ruthven
University of Cambridge

David A. Smith
Duke University

Edna Vasquez
Detroit Renaissance High School

Curriculum Development Consultants
Alverna Champion
Grand Valley State University

Cherie Cornick
Wayne County Alliance for Mathematics and Science

Edgar Edwards
(Formerly) Virginia State Department of Education

Kenneth Ross
University of Oregon

Richard Scheaffer
University of Florida

Martha Siegel
Towson University

Edward Silver
University of Pittsburgh

Lee Stiff
North Carolina State University

Paul Zorn
St. Olaf College

Collaborating Teachers
Emma Ames
Oakland Mills High School, Maryland

Cheryl Bach
Sitka High School, Alaska

Mary Jo Messenger
Howard County Public Schools, Maryland

Valerie Mills
Ann Arbor Public Schools, Michigan

Jacqueline Stewart
Okemos High School, Michigan

Michael Verkaik
Holland Christian High School, Michigan

Marcia Weinhold
Kalamazoo Area Mathematics and Science Center, Michigan

Graduate Assistants
Kelly Finn
University of Iowa

Judy Flowers
University of Michigan

Johnette Masson
University of Iowa

Chris Rasmussen
University of Maryland

Bettie Truitt
University of Iowa

Roberto Villarubi
University of Maryland

Rebecca Walker
Western Michigan University

Ed Wall
University of Michigan

Technical Coordinator
Wendy Weaver
Western Michigan University

Production and Support Staff
James Laser
Kelly MacLean
Jennifer Rosenboom
Kathryn Wright
Teri Ziebarth
Western Michigan University

Software Developers
Jim Flanders
Colorado Springs, Colorado

Eric Kamischke
Interlochen, Michigan

UNIFIED MATHEMATICS

Each course of *Contemporary Mathematics in Context* features "strands" of algebra and functions, statistics and probability, geometry and trigonometry, and discrete mathematics. These strands are connected within units by fundamental ideas such as symmetry, functions, matrices, data analysis, and curve-fitting. The strands also are connected across units by mathematical habits of mind such as visual thinking, recursive thinking, searching for and describing patterns, making and checking conjectures, reasoning with multiple representations, inventing mathematics, and providing convincing arguments. The strands are linked further by the fundamental themes of data, representation, shape, and change. Important mathematical ideas are continually revisited through these connections so that students can develop a robust understanding of mathematics.

Algebra and Functions

The algebra and functions strand develops student ability to recognize, represent, and solve problems involving relations among quantitative variables. Central to the development is the use of functions as mathematical models. The key algebraic models in the curriculum are linear, exponential, power, and periodic functions and combinations of those basic types. Each algebraic model is investigated in at least three linked representations—graphic, numeric, and symbolic—with the aid of technology. Attention is also given to modeling with systems, both linear and nonlinear, and to symbolic reasoning.

Statistics and Probability

The primary role of the statistics and probability strand is to develop student ability to analyze data intelligently, to recognize and measure variation, and to understand the patterns that underlie probabilistic situations. Graphical methods of data analysis, simulations, sampling, and experience with the collection and interpretation of real data are featured.

Geometry and Trigonometry

The primary goal of the geometry and trigonometry strand is to develop visual thinking and student ability to construct, reason with, interpret, and apply mathematical models of patterns in visual and physical contexts. Specific activities include describing patterns with regard to shape, size, and location; representing patterns with drawings, coordinates, or vectors; predicting changes and invariants in shapes and patterns; and organizing geometric facts and relationships through deductive reasoning.

Discrete Mathematics

The discrete mathematics strand develops student ability to model and solve problems involving decision making in finite settings, relationships among a finite number of elements, sequential change, and enumeration. Topics include matrices, vertex-edge graphs, recursion, models of social decision making, and systematic counting methods. Key themes are existence *(Is there a solution?)*, optimization *(What is the best solution?)*, and algorithmic problem solving *(Can you efficiently construct a solution?)*.

ORGANIZATION OF THE CURRICULUM

Each of the first three courses of the *Contemporary Mathematics in Context* curriculum consists of seven units and a culminating capstone experience. The final element of each course, the capstone, is a thematic, two-week, project-oriented activity that enables students to pull together and apply the important mathematical concepts and methods developed in the entire course. Unit titles for the three-year core curriculum for all students are given in the following table.

Unit	Course 1	Unit	Course 2	Unit	Course 3
1	Patterns in Data	1	Matrix Models	1	Multiple-Variable Models
2	Patterns of Change	2	Patterns of Location, Shape, and Size	2	Modeling Public Opinion
3	Linear Models	3	Patterns of Association	3	Symbol Sense and Algebraic Reasoning
4	Graph Models	4	Power Models	4	Shapes and Geometric Reasoning
5	Patterns in Space and Visualization	5	Network Optimization	5	Patterns in Variation
6	Exponential Models	6	Geometric Form and Its Function	6	Families of Functions
7	Simulation Models	7	Patterns in Chance	7	Discrete Models of Change
CAPSTONE	Planning a Benefits Carnival	CAPSTONE	Forests, the Environment, and Mathematics	CAPSTONE	Making the Best of It: Optimal Forms and Strategies

In developing *Contemporary Mathematics in Context*, the Core-Plus Mathematics Project chose mathematical content the developers believe is the most important mathematics all high school students should have the opportunity to learn. Because of the importance and broad usefulness of the content in each course, we recommend that all units in a course be completed by students before they embark on the next course.

The Strand Charts

The following charts will help you understand the content and flow of Courses 1–3 in the *Contemporary Mathematics in Context* curriculum. Each of the four strands has been divided into major categories, and under each of these categories you will find the mathematical topics presented in *CMIC*.

Many cells in the grid have either a "✓" or a "+" to indicate the units in which each topic is covered. The "✓" indicates *focus;* this means the topic is initially developed or extended beyond its initial development or use. The "+" indicates *connection,* which means that a conceptual basis for the topic is developed, the topic is briefly introduced but not developed, or the topic is revisited and used without further development.

ALGEBRA AND FUNCTIONS

✔ Focus + Connections

	Course 1							Course 2							Course 3						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Algebraic Representations																					
Coordinate graphs	✔	✔	+			+		+	✔	+	+		+	+	✔		+	+		✔	+
Tables and graphs	+	✔	✔		+	✔		+	+		✔		+	+	✔		+			✔	+
Modeling data patterns	+	✔	✔			✔				✔	✔		+	+	+		+			✔	+
Error of prediction and residuals			✔							✔	+										
Matrices				✔				✔	✔	+											+
Coordinate models of transformations									✔												
Summation notation	+									+				+					+		✔
Linear Expressions and Relations																					
Modeling situations		+	✔		+			+		✔					+		+			✔	+
Symbolic forms and effects of parameters		✔	✔			+				+	+						+			✔	✔
Graphs and equations of lines		✔	✔					✔	✔	+	+				+		+			✔	
Solving equations		✔	✔					+							+		✔				+
Solving inequalities		✔	✔												+		✔				+
Rates of change, slopes, and intercepts			✔			+			+	+	+				+		+			+	✔
Exponential Expressions and Relations																					
Modeling situations		+				✔								+			+			✔	+
Symbolic forms and effects of parameters		✔				✔					+						+			✔	+
Graphs and intercepts		✔				✔											+			✔	
Solving equations and inequalities		+				✔											+				+
Rates of change						✔														✔	
Asymptotes																	+			✔	
Power Expressions and Relations																					
Symbolic forms and effects of parameters		+									✔						+			✔	
Graphs and intercepts		+									✔						+			✔	
Fractional and negative exponents						+					✔										
Laws of exponents						+					✔						+				
Modeling situations											✔						+			✔	
Inverse variation											✔				+		+			✔	
Asymptotes (inverse variation)											+				+		+			✔	
Solving equations and inequalities											✔						+				
Roots and radicals											✔						+			✔	
Rates of change											+						+			✔	
Quadratic Expressions and Relations																					
Modeling situations		+									✔						+			+	
Symbolic forms and effects of parameters		+									✔						+			✔	
Graphs and intercepts		+									✔				+		✔			+	
Rates of change		+									+									+	
Solving equations by graphic and numeric approximation		+									✔				+		+			+	
Number of solutions											✔				+		✔			+	
Solving inequalities											✔				+		✔				
Higher-degree polynomials											✔						✔			✔	
Solving equations by factoring																	✔				
Solving equations by using the quadratic formula																	✔				
Rational Expressions and Relations																					
Symbolic forms and effects of parameters		+															+			✔	
Graphs and intercepts		+													+						
Rates of change											+						+				
Modeling situations															+		✔				
Solving equations and inequalities															+		+				
Asymptotes																				✔	

ALGEBRA AND FUNCTIONS

✔ Focus + Connections

	Course 1							Course 2							Course 3						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Periodic Expressions and Relations																					
Modeling situations		+											✔				+			✔	
Symbolic forms and effects of parameters		+											✔				+			✔	
Graphs and intercepts		+											+				+			✔	
Multivariable Expressions																					
Formulas	+	+			+					✔			+		✔		+	+			
Pythagorean Theorem					✔				+		+		+		+		+				
Law of Sines and Law of Cosines															✔		✔	+			
Modeling using symbolic equations and inequalities															✔		+				
Solving for one variable in terms of others															✔						
Effect of change among variables															✔						
Systems of Relations																					
Solving linear systems by graphical and numeric methods			✔					+	✔						+						+
Solving linear systems by substitution			✔					+	✔						+						+
Graphing systems			+						✔						✔						
Solving linear systems by matrix methods								✔	+						+						+
Solving linear systems by linear combinations									✔						+						
Solving systems of linear inequalities															✔						
Linear programming															✔						
Linear-quadratic systems															✔						
Functions																					
Definition and notation		+															✔			+	+
Rates of change		+	✔			+			+	+	+						+			✔	
Transformations of graphs		+	+			+			+		+						✔			✔	
Domain and range			+			+					+						✔			✔	
Composition of functions									+												+
Sequences and series													+								✔
Algebraic Reasoning																					
Equivalent expressions			✔			+					+				✔		+			+	
Distributive property			+					+									✔	+		+	
Commutative properties			+					+									✔	+		+	
Laws of exponents						+					✔						+				
Associative properties								+									✔	+		+	
Properties of equations								+	+						✔		+	+		+	
Additive inverse								+							+		+				
Multiplicative inverse								+							+		+				
Radicals and operations											✔				+		+				
Algebraic proof													+				✔	+		+	+
Polynomials and binary operations																	✔			✔	
Factoring, expanding, and simplifying																	✔				
Calculus Underpinnings																					
Rates of change		+	✔			✔			+	+	+				+		+			+	✔
Maxima and minima		+			+						✔		+				+			+	+
Limits														+						+	✔
Sequences and series														+							✔

Course 4 topics include vectors; parametric equations; fundamental concepts underlying calculus (including the concepts of limit, derivative, and integral); composite and inverse functions; logarithmic functions; further work with polynomial and rational functions; complex numbers; symbolic manipulation of polynomial, rational, exponential, logarithmic, and trigonometric expressions; solving exponential, logarithmic, and trigonometric equations; and algebraic structures.

STATISTICS AND PROBABILITY

✔ Focus + Connections

	Course 1							Course 2							Course 3						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Univariate Data																					
Number line (dot) plots	✔																				
Measures of center and their properties	✔			+			+							+			+		+		
Basic shapes	✔						+														
Skewness and symmetry	✔						+							+							
Histograms	✔						+							+					+		
Clusters, gaps, and outliers	✔									✔				+					✔		
Box plots	✔															+					
Range	✔																+				
Linear transformations of data	✔																+		+	+	
Stem-and-leaf plots	✔																		+		
Interquartile range (IQR)	✔																		+		
Mean absolute deviation (MAD)	✔																		+		
Percentiles	✔																		+		
Standard deviation and its properties	+																		✔		
Quartiles	✔																				
Frequency tables							✔							✔							
Standardized and *z*-scores																			✔		
																			✔		
Bivariate Data																					
Scatterplots and association	✔	+	+		+					✔	+								+	+	
Plots and trends over time	✔									+									+		+
Sum of squared differences	+									✔									✔		
Centroid	+									✔											
Least squares regression lines			✔			+				✔	+								+	+	
Errors of prediction and residuals			+							✔	+										
Nonlinear regression						✔					✔									+	
Influential points										✔									✔		
Spearman's rank correlation coefficient										✔											
Scatterplot matrices										✔											
Pearson's correlation coefficient *r*										✔											
Correlation matrices										✔											
Explanatory and response variables										✔											
Lurking variables										✔											
Cause-and-effect relationships										✔											
Probability																					
Normal distribution	+																		✔		
Simulation						+	✔							+		+					
Random digit tables and random number generators							✔														
Law of Large Numbers							✔														
Empirical (experimental) and theoretical probabilities							✔							✔					+		
Independent events							✔							✔					+		
Binomial distribution							+							+		+					
Geometric (waiting-time) distribution							+							✔							
Multiplication Rule for independent events														✔					+		
Geometric (area) models														✔							
Conditional probability														✔							
Expected value														✔							
Rare events														+					+		
Sampling distributions																✔			+		
Mutually exclusive events																			✔		
Addition Rule for mutually exclusive events																			✔		
Central Limit Theorem																			+		

STATISTICS AND PROBABILITY

✔ Focus + Connections

	Course 1							Course 2							Course 3						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Surveys																					
Sample survey vs. census																✔					
Sample size																✔					
Simple random sample																✔					
Bias in survey method																✔					
Response rate																✔					
Inferential Statistics																					
Population vs. sample																✔			+		
Confidence intervals																✔					
Margin of error																✔					
Control (run) charts																			✔		
Hypothesis testing																			+		

Course 4 topics include modeling using logarithmic functions (including semi-log and log-log transformations); binomial distributions, binomial probabilities; the binomial probability formula; hypothesis tests for proportions; categorical data; chi-square distributions and tests.

GEOMETRY AND TRIGONOMETRY

✔ Focus + Connections

	Course 1							Course 2							Course 3						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Three-dimensional Shapes																					
Regular (Platonic) solids				+	✔																
Right polygonal prisms and pyramids					✔						+										
Cones and cylinders					✔																
Sketching shapes					✔																
Rigidity					✔																
Bilateral symmetry					✔																
Two-dimensional Shapes																					
Definitions of polygons					✔																
Characteristics of polygons and special quadrilaterals					✔				✔				+					✔			
Bilateral and rotational symmetry					✔				+		+										
Translational symmetry					✔				+												
Angle sums of polygons					✔								+		+		+	+			
Tessellations					✔																
Congruence					+				+				+					✔			
Properties of parallelograms					+				+				+				+	✔			
Similarity									✔				+		+			✔			
Modeling plane shapes with coordinates									✔								+	+			
Triangular and quadrilateral linkages													✔		+						
Measures																					
Area		+			✔	+					+				+		+	+			
Perimeter		+			✔						✔										
Pythagorean Theorem					✔				+		+		+		+		✔	+			
Volume					✔						✔				+						
Surface area					✔						+				+						
Angular velocity													✔								
Linear velocity													✔								
Coordinate Models and Graphs																					
Coordinate graphs	✔	✔	+					+	+								+	+		✔	
Geometry of function graphs		+									+									✔	
Slope of a line			✔						+									+	+		
Equations of lines								✔	✔						✔						
Slopes of parallel and perpendicular lines									✔									+	+		
Distance and midpoint of a segment									✔									+	+		
Coordinate representation of transformations									✔												
Congruence and similarity									✔												
Matrix representation of polygons									✔												
Coordinate proof																		✔	+		
Transformations and Symmetries																					
Bilateral and rotational symmetry	+				✔				+		+									+	
Fractals				+		+															+
Translational symmetry					✔				+											+	
Tessellations					✔																
Strip patterns					✔																
Isometric transformations					✔				✔											+	
Size transformations									✔		+		✔					+		+	
Matrix representation of transformations									✔												
Transformation of graphs and function rules		+	+			+			+		+						✔			✔	

GEOMETRY AND TRIGONOMETRY

✔ Focus + Connections

	Course 1							Course 2							Course 3						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Trigonometry																					
Periodic change		+											✔				+			✔	
Triangular linkages with one variable side													✔		+						
Trigonometric ratios and functions (sine, cosine, and tangent)													✔		+		+				
Indirect measurement (angles and lengths)													✔		✔		+				
Circular and periodic motion													✔				+			✔	
Period													✔				+			✔	
Periodic models													✔				+			✔	
Trigonometric graphs ($y = A\sin Bx$ and $y = A\cos Bx$)													✔				+			✔	
Radian and degree measure													✔							+	
Amplitude													✔							✔	
Law of Cosines															✔		✔	+			
Law of Sines															✔		+	+			
Reasoning from Assumptions: Proof																					
Inductive reasoning	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	✔	+	+	+
Counterexamples				+	+			+	+	+	+					+	+	✔			
Deductive reasoning					+							+	+		+		+	✔			+
Designing and programming algorithms									✔			+									
Coordinate and analytic proof																	✔	✔			
Synthetic proof																		✔			
Assumptions in proof																		✔			
Principles of logic																		✔			
Converse																		✔			
Angle relations for two intersecting lines																		✔			
Angle relations for three intersecting lines																		✔			
Parallelism																		✔			
Similarity conditions for triangles																		✔			
Congruence conditions for triangles																		✔			
Necessary and sufficient conditions for parallelograms																		✔			
Geometric constructions																		✔			

Course 4 topics include two dimensional vectors and their use in modeling motion, symbolic manipulation of trigonometric expressions, solving trigonometric equations, proving trigonometric identities, geometric representations of complex numbers and complex number operations, three-dimensional shapes, contours, cross-sections, reliefs, surfaces defined by algebraic equations and surfaces of revolution, lines in space, sketching three-dimensional shapes; and algebraic structures in geometry.

DISCRETE MATHEMATICS

✔ Focus + Connections

	Course 1							Course 2							Course 3						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Vertex-Edge Graphs																					
Vertex-edge graph models				✔	+	+		+		+		✔						+			+
Digraphs				✔				+		+		+									
Adjacency matrices for vertex-edge graphs				✔				✔				+									
Euler paths and circuits				✔																	
Graph coloring				✔																	
Critical path analysis and PERT charts				✔																	
Trees and minimal spanning trees						+						✔									
Shortest paths												✔									
Hamiltonian paths and circuits												✔									
Recursion and Iteration																					
Representation using the words NOW and NEXT		✔	+	+		✔		+					+							+	✔
Representations of linear functions		+	✔																		✔
Representations of exponential functions		+				✔															✔
Recursion equations (difference equations)		+	+			+															✔
Fractals				+		+															+
Composition of functions									+												+
Sequences and series														+							✔
Function iteration																					✔
Finite differences																					✔
Fixed points																					✔
Graphical iteration																					✔
Matrices																					
Adjacency matrices for vertex-edge graphs				✔				✔				+									
Matrix models				+				✔	✔			✔									+
Row and column sums				+				✔				+									
Matrix addition								✔	+												+
Scalar multiplication								✔	+												+
Matrix multiplication								✔	+												+
Identity matrices								✔	+												+
Inverse matrices								✔	+												+
Matrix solutions of linear systems								✔	+							+					+
Properties of matrices								✔													
Transformation matrices									✔												
Scatterplot matrices										✔											
Social Decision Making																					
Preferential voting																✔					
Approval voting																✔					
Vote-analysis methods																✔					
Arrow's Theorem																✔					
Algorithms																					
Optimization				✔								✔				+		+			
Algorithmic problem solving				✔					+			✔									+
Designing and programming algorithms									✔			+					+				
Analyzing and comparing algorithms												✔									

Course 4 topics include systematic counting, Multiplication Principle of Counting, combinations and permutations, selections, Binomial Theorem, combinatorial reasoning and proof, mathematical induction, algorithms, sequences and series, optimization in multivariable situations, information processing, cryptography, error correcting codes, and data compression.

Item No. 39499

ISBN 1-57039-499-7

Chicago, Illinois

BEST COPY AVAILABLE